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Editorial

Announcing a new section on Pharmaceutical Nanotechnology in *IJP*

Many papers published in the *International Journal of Pharmaceutics* deal with systems in the nanometre size range, some examples of which are referenced here (Kohli and Alpar, 2004; Li et al., 2003; Ricci et al., 2004; Seki et al., 2004; Kim and Kim, 2003; Chen et al., 2004; Bivas-Benita et al., 2003). In view of the widespread and increasing importance of nanotechnology in the pharmaceutical sciences the Editorial team have decided that the journal should have a section devoted to pharmaceutical nanotechnology. We now invite authors to contribute to this section and to indicate when submitting manuscripts whether they wish to have their papers considered for publication in this distinctive way.

Some have argued that nanotechnology is simply a re-invention of colloid science but this is to miss the point and to confuse the technology with the object. While colloids were first described and the word colloid "invented" by Thomas Graham in 1845, and nanosized particles have existed in nature for example in dust and the environment since time immemorial, the first nanoparticles for pharmaceutical use were reported by Peter Speiser of ETH in Zurich in the late 1970s. (Birrenbach and Speiser, 1976; Kreuter, 1978; Marty et al., 1978). These systems were rather quaintly named "nanoparts", but they presaged a huge interest in the preparation and application of sub-micron systems in pharmacy. There are now a wide range of nanosystems, not only nanoparticles and nanocapsules but lipid complexes, polymer micelles, dendrimers and other forms. Nanotechnology is of course much more than the nanoparticles themselves, although nanoparticulates such as dendrimers have a special place given that this class of synthetic branched polymer has well defined and controlled size, a given spatial architecture and monodisperse nature.

What makes nanotechnology a new and exciting subject is the ability not only to manipulate nanoparticles and nanosystems but also the new techniques available to measure and indeed visualise material in the nanometre size range. More than this, it is the growth of technologies based on such small-scale systems: microfluidic devices and laboratories on chips rely on an understanding and control of nanoparticle flow in confined spaces. We have argued (Florence, 2004) that nanoparticle flow and interactions *in vivo* are of crucial importance in nanoparticle drug targeting and fate. Diffusion of nanoparticles in complex media is a topic that requires significant research if we are to understand and harness the biological environments in which nanocarriers must travel to reach their targets. The very nature of pharmaceutical nanotechnology is that the particles are small, hence particle size is crucial and the maintenance of particle size therefore is paramount. If destination, fate and targeting ability rely on the designed particle size, then the avoidance of aggregation or flocculation is a must. There needs to be rational thought given to the preservation of colloid stability while at the same time ensuring that these measures do not affect the biological fate of the particles. To separate the physical and biological sciences in this regard is fatal, but unfortunately many of the stratagems for maintaining stability, such as coating of hydrophobic particles with long-chain hydrophilic molecules mitigates against uptake by certain cells. The attachment of biological ligands to surfaces of nanoparticles not only provides some targeting specificity but also, as ligands are generally

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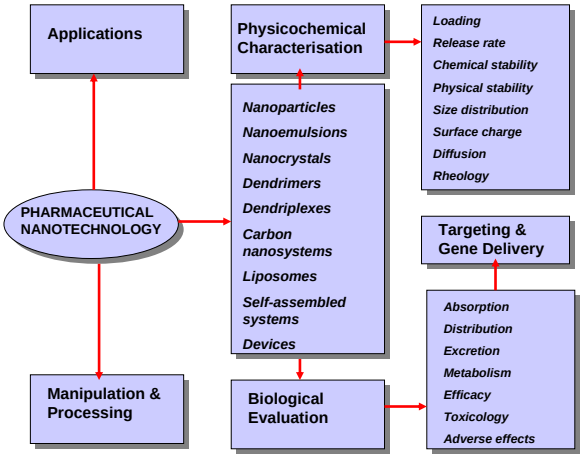

Fig. 1. Topics of interest in pharmaceutical nanotechnology.

macromolecular in nature, this process changes the nature of the surface and might well compromise stability.

Figure 1 represents a first attempt at categorising the areas of interest to readers of *IJP*. As the subject develops this can be elaborated. It is not exhaustive but encompasses the physical characterisation, the production and biological evaluation of any systems of nanometre size dimensions. Nanoparticles are of use not only as drug carriers but as the components of new materials, as templates for the synthesis of materials, and potentially as lubricants of miniaturised parts. Nanocrystals can now be prepared in a variety of forms and shapes by a variety of techniques. Papers on these topics and on nanoparticle stability, nanoparticle diffusion in cells and tissues, polymer-drug (especially oligomeric or macromolecular drugs) interactions in nanosystems are all on relevant topics which *IJP* editors will be happy to consider.

The first papers published will be those that have been submitted in the normal course of events to us. This initiative of highlighting the topic of pharmaceutical nanotechnology will, we hope, stimulate authors to submit their work to us. Reviews are particularly welcome in the future as the array of nanosystems is growing. Let us ensure that the pharmaceutical technology of nanosystems is not lost and that the processing, manipulation, production as well as the basic physicochemical evaluation of such systems is encouraged alongside their vital biological evaluation. *IJP* is an important medium where this interdisciplinary work will be presented to a large international audience.

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